Human Systems
integration division

Man-machine Integration Design and Analysis System (MIDAS)

Objective

The Man-machine Integration Design and Analysis System (MIDAS) is a human performance modeling and simulation environment that facilitates the design, visualization, and computational evaluation of complex man-machine system concepts in simulated operational environments. This human performance modeling methodology also enables the design and evaluation of procedures at early phases of a design concept.

MIDAS Visualization Output of Multi-Crew Operations

Approach

MIDAS is a 3-D rapid prototyping research methodology that was developed to allow evaluation of operational concepts and procedures through the use of computational representations of a human operator in a virtual environment. The virtual human within the MIDAS software is comprised of a physical anthropometric character that is linked into a computational cognitive structure that represents human capabilities and limitations. The cognitive component is made up of a perceptual mechanism (visual and auditory), memory, a decision maker and a response selection architectural component. The complex interplay among bottom-up and top-down processes enables the emergence of unforeseen, un-programmed behaviors. MIDAS outputs include dynamic visual representations of the simulation environment, timelines, task lists, cognitive loads along 6 resource channels, actual/perceived situation awareness, human error vulnerability and human performance quality.

Impact

MIDAS offers an integrated human performance-modeling environment to simulate, evaluate and visualize notional designs and procedures in a human-out-of-the-loop/virtual operational environment in a safe and cost efficient manner. The MIDAS modeling environment has been used to model military missions performed in an Apache helicopter and soldiers wearing protective gear, civil tiltrotors and commercial jets flying approaches, 911 operators responding to emergencies, and to construct a virtual rendition of the shuttle cockpit that incorporates a virtual rendition of the Space Life Sciences glove box. Recent advances (e.g., embedding error probability functions at various levels of performance and cross referencing these error prediction mechanisms with human performance vulnerabilities) have enabled MIDAS to generate errors realistic and unscripted errors and to predict the likelihood of other types of performance decrements. MIDAS operating platform has been refined to be cross-platform compatible.

NASA Programs and Collaborations

This work is part of the Secure Operations and Procedures Element of the Protected Asset Flight Systems (PAFS) sub-Project within the Aviation Safety and Security Program.

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URL: http://humansystems.arc.nasa.gov/groups/midas